كلية الهندسة
البرامج الخاصة

امتحان مادة الكيمياء الهندسية
الفصل الدراسي الأول ٢٠١٣/٢٠١٤
الخميس ٢٠١٤/١/١٦ الزمن: ٢ ساعات

جامعة المنصورة

**Answer the following questions** **Total Marks 50** أجب عن الأسئلة الآتية:

**(N=14, C=12, H=1 and O=16)**

**Question No. (1)** **(10 Marks)**

(a) Define the concept of partial pressure and derive the relationship between partial pressure, total pressure and mole fraction of a component gas in a gas mixture? **(3 Marks)**

(b) List two conditions under which gas can deviat from ideal behaviour and show how you can obtain van der Waals equation of state by the modification of the ideal gas equation of state? **(3 Marks)**

(c) Compute the molecular weight of gas mixture and its density at 27 °C and 750 torr, if the mixture of gases has the following composition by weight: $CO_2$=0.44%, $O_2$=22.4%, $N_2$=75.36% $H_2O$=1.8%? **(4Marks)**

**Question No. (2):** **(10 Marks)**

(a) State the three laws of thermodynamic? **(3 Marks)**

(b) Derive the relationship between $C_P$ and $C_v$ for Real gases? **(3 Marks)**

(c) Reffering to the information in the table at 25°C: **(4 Marks)**

(1) Calculate $\Delta S°_r$ at 25°C for the reaction:
$CO_{(g)} + 2H_{2(g)} = CH_3OH_{(l)}$

(2) Calculate $\Delta S°$ for $CO_{(g)}$ at 25°C.

(3) Discuss the effect of temperature on the spontaneity of the above reaction

| Compound | $\Delta H°_f$ kcal/mole | $\Delta G°_f$ kcal/mole | $S°$ cal/mole K |
|---|---|---|---|
| $H_{2(g)}$ | 0.00 | 0.00 | 31.212 |
| $CO_{(g)}$ | -26.415 | -32.808 | ------- |
| $CH_3OH_{(l)}$ | -57.036 | -39.747 | 30.26 |

**Question No. (3):** **(10 Marks)**

(a) What is meant by colligative properties of solutions? **(2Marks)**

(b) Ethylene glycol $C_2H_6O_2$ is used as anti-coolant in vehicle's engine cooler (رديـاتير السيارات), specially in cold climates. If the temperature reached to -10°C, what weight of ethylene glycol $C_2H_6O_2$ must be added to 100 gm of water to prevent the formation of ice? **(consider $\Delta H_{fus.}$ =1436 cal/mol for water )** **(4Marks)**

(c) What is the denisty at 17°C of aqueous solution containing 0.75 gm of sucrose, ($C_{12}H_{22}O_{11}$), per 2 litre of a solution developed a rise of 26.4 cm at osmotic equilibrium? **(4Marks)**

**Question No. (4):** **(10 Marks)**

(a) Explain the main features of the phase diagram of water? State the phase rule and explain what is meant by its parameters? Apply this rule to interpret the tripple point of water on its phase diagram? **(4Marks)**

(b) Study the effect of pressure on the melting point of water, starting from a pressure of 1 to 101 atm with an incrimintal chang of 20 atm, where the density of liquid water at 0°C is given as 0.99 gm/cm$^3$ and that for ice at 0°C is 0.92 gm/cm$^3$. **(consider $\Delta H_{fus.}$ =1436 cal/mol for water )** **(6Marks)**

**Question No. (5):** **(10Marks)**

(a) Give different Four examples of cathodic reactions and different five examples of anodic reactions? **(3Marks)**

(b) Based on the relation between electrode potentials and free energy change, derive the Nernst equation? **(2Marks)**

(c) I- Calculate $E°_{cell}$ for the reaction: $\mathbf{Cu^{++} + Zn = Cu + Zn^{++}}$ **(5Marks)**

II- What is the potential of the cell containing ($Zn^{++}/Zn$) and ($Cu^{++}/Cu$)couples if the $Zn^{++}$ and $Cu^{++}$ concentrations are 0.1and $10^{-9}$ molar, respectively, at a temperature of 25°C.

III- What is the value of $\Delta G$ for the reduction of one mole of $Cu^{++}$ ions by Zn at the indicated concentrations of the ions, given in (b), at temperature of 25°C. Also, what is the value of $\Delta G°$ for the reaction at 25°C.

If you are taken that: $\mathbf{Zn^{++} + 2e = Zn}$ **E° = -0.763 v** **and** $\mathbf{Cu^{++} + 2e = Cu}$ **E°=0.337 v.**

انتهت الأسئلة مع أطيب التمنيات بالتوفيق والنجاح
أ.د/ أحمد أحمد الصروى